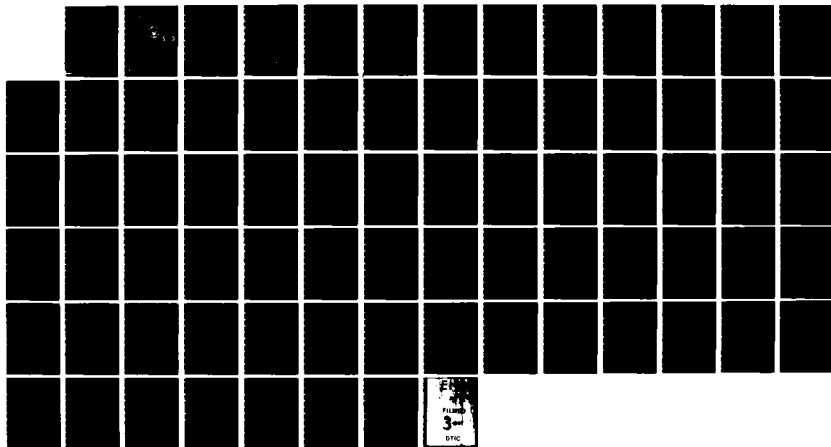


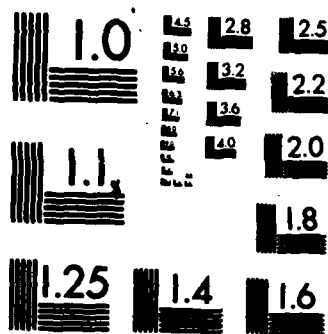
ENLISTMENT STANDARDS AS RELATED TO PERFORMANCE IN  
AVIATION ANTISUBMARINE. (U) NAVAL POSTGRADUATE SCHOOL  
MONTEREY CA C D SANDEL ET AL. SEP 83

UNCLASSIFIED

F/G 5/9

NL





MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

2

AD A137558

# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



DTIC  
ELECTE  
FEB 6 1984  
S B D

# THESIS

ENLISTMENT STANDARDS AS RELATED TO  
PERFORMANCE IN AVIATION ANTISUBMARINE  
WARFARE OPERATOR AND AVIATION  
ANTISUBMARINE WARFARE TECHNICIAN RATINGS

by

Clyde D. Sandel

and

Mary F. Gleason

September 1983

Thesis Co-Advisors:

R. S. Elster

W. E. McGarvey

Approved for public release, distribution unlimited.

DTIC FILE COPY

84 02 6 104

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. <b>A137558</b>	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Enlistment Standards as Related to Performance in Aviation Antisubmarine Warfare Operator and Aviation Anti- submarine Warfare Technician Ratings		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis September 1983
7. AUTHOR(s) Clyde D. Sandel and Mary F. Gleason		6. PERFORMING ORG. REPORT NUMBER
8. CONTRACT OR GRANT NUMBER(s)		
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943		12. REPORT DATE September 1983
		13. NUMBER OF PAGES 74
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) AX and AW Ratings Enlistment Standards, Enlistment Standards for AX and AW Ratings.		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The purpose of this study is to discover if the Navy's system of assigning personnel to the Aviation Antisubmarine Warfare Technician (AX) and the Aviation Antisubmarine Warfare Operator (AW) ratings can be improved. A multivariable model is developed using "success" and "failure" as criterion variables. Bio- graphical and aptitude data available at the time of enlistment are used as predictor variables. Two independent models were —		

DD FORM 1 JAN 79 1473

EDITION OF 1 NOV 65 IS OBSOLETE  
S/N 0102-LF-014-6601

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Block 20 (continued)

created using data available on personnel entering the Navy in 1976, 1977 and 1978. The models were then validated on a new sample.

These models predict the future fleet performance of AX and AW personnel as measured by length of service, paygrade achieved, and recommendation for reenlistment. Other results and recommendations regarding implementation and future research are discussed.

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	



S/N 0102- LP-014-4401

2

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Approved for public release, distribution unlimited.

Enlistment Standards as Related to Performance in  
Aviation Antisubmarine Warfare Operator and  
Aviation Antisubmarine Warfare Technician Ratings

by

Clyde D. Sandel  
Lieutenant Commander, United States Navy  
B.A., Angelo State University, 1973

and

Mary F. Gleason  
Lieutenant, United States Navy  
B.S., University of Southern Mississippi, 1973

Submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL  
September 1983

Authors:

Clyde D. Sandel, LCDR USN

Mary F. Gleason, LT USN

Approved by:

William E. McGarry

Co-Advisor

Richard L. Elster

Co-Advisor

Richard L. Elster

Chairman, Department of Administrative Science

K. T. Marshall  
Dean of Information and Policy Sciences

## ABSTRACT

The purpose of this study is to discover if the Navy's system of assigning personnel to the Aviation Antisubmarine Warfare Technician (AX) and the Aviation Antisubmarine Warfare Operator (AW) ratings can be improved. A multivariate model is developed using "success" and "failure" as criterion variables. Biographical and aptitude data available at the time of enlistment are used as predictor variables. Two independent models were created using data available on personnel entering the Navy in 1976, 1977 and 1978. The models were then validated on a new sample.

These models predict the future fleet performance of AX and AW personnel as measured by length of service, paygrade achieved, and recommendation for reenlistment. Other results and recommendations regarding implementation and future research are discussed.

## TABLE OF CONTENTS

I.	INTRODUCTION -----	8
II.	DATA BASE DEVELOPMENT -----	11
III.	THE VARIABLES -----	13
	A. BACKGROUND -----	13
	B. CRITERION VARIABLES -----	17
	C. PREDICTOR VARIABLES -----	19
IV.	STATISTICAL TECHNIQUES -----	21
	A. FREQUENCY ANALYSIS -----	21
	B. MULTIVARIATE CORRELATION ANALYSIS -----	21
	C. STEPWISE REGRESSION -----	22
	D. DISCRIMINANT ANALYSIS -----	22
V.	MODELS -----	24
	A. AX MODEL -----	24
	B. AW MODEL -----	26
	C. ADDENDUM -----	27
VI.	CONCLUSIONS -----	29
	LIST OF REFERENCES -----	70
	BIBLIOGRAPHY -----	72
	INITIAL DISTRIBUTION LIST -----	74



# LIST OF TABLES

1.	INTER-SERVICE SEPARATION CODE FOR THE AW RATING -----	31
2.	INTER-SERVICE SEPARATION CODE FOR AX RATING -----	32
3.	PREDICTOR VARIABLES -----	33
4.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE GI -----	34
5.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE NO -----	35
6.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AD -----	36
7.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE WK -----	37
8.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AR -----	38
9.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE SP -----	39
10.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE MK -----	40
11.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE EI -----	41
12.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE MC -----	42
13.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE GS -----	43
14.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE SI -----	44
15.	AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AI -----	45
16.	AW SCREEN SCORE -----	46
17.	AW RACE DISTRIBUTION -----	47
18.	AW ENTRY PAY GRADE (E00-011) -----	47
19.	AW MARITAL STATUS/DEPENDENTS -----	47
20.	AW AFQT SCORE FREQUENCY -----	48
21.	AW TERM OF ENLISTMENT (NO. OF YEARS) -----	49
22.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE GI -----	49
23.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE NO -----	50

24.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AD -----	51
25.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE WK -----	52
26.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AR -----	53
27.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE SP -----	54
28.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE MK -----	55
29.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE EI -----	56
30.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE MC -----	57
31.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE GS -----	58
32.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE SI -----	59
33.	AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AI -----	60
34.	AS SCREEN SCORE -----	61
35.	AX RACE DISTRIBUTION -----	62
36.	AX ENTRY PAY GRADE (E00-011) -----	62
37.	AX MARITAL STATUS/DEPENDENTS -----	62
38.	AX AFQT PERCENTILE (OR EQUIVALENT) -----	63
39.	AX TERM OF ENLISTMENT (NO. OF YEARS) -----	64
40.	AX STEPWISE SELECTION: SUMMARY TERMENLT AS A VARIABLE -----	64
41.	AX STEPWISE SELECTION: SUMMARY WITHOUT TERMENLT -----	64
42.	AX DISCRIMINANT ANALYSIS -----	65
43.	AW STEPWISE SELECTION: SUMMARY WITH TERMENLT -----	66
44.	AW STEPWISE SELECTION: SUMMARY WITHOUT TERMENLT -----	66
45.	AW DISCRIMINANT ANALYSIS -----	67
46.	AX DISCRIMINANT ANALYSIS -----	68
47.	AW DISCRIMINANT ANALYSIS -----	69

## I. INTRODUCTION

The objective of this study is to discover if selection standards for Aviation Antisubmarine Warfare Technicians (AX) and Aviation Antisubmarine Warfare Operators (AW) can be improved by utilizing data available at the time of enlistment. Studies concerning personnel assignments to ratings have traditionally used training criteria, with completion of Class A School as the measure of success for validation [Ref. 1]. Other studies have focused on whether or not an individual leaves the service as the measure of success. This study will use measures of the operational performance of AX's and AW's in the fleet as the dependent variables.

The following discussion provides a brief overview of each rating.

AX - The AX rating is responsible for keeping aviation antisubmarine warfare (ASW) weapon systems and system components operating in good condition. As such, the training for the rating is of a highly technical nature. The AX community is relatively small and is unique to those Naval squadrons whose principal purpose is air antisubmarine warfare. Such squadrons consist of the S-3, P-3, HS and HSL. these squadrons' operational mission effectiveness is directly linked to the performance and quality of the members of the AX rating. AX's perform in-flight maintenance of airborne electronic systems, remove and install

units of ASW equipment, maintain operating efficiency of ASW equipment, perform a wide range of electronic shop operations, debrief flight crews, and read and apply equipment service diagrams, schematics and manuals. Important qualifications for the AX rating include manual dexterity, arithmetic ability and an ability to do detail work [Ref. 2].

AW - The AW rating is comprised of two components, AWA (Acoustics Operators) and AWH (Non-Acoustic Operators). For the purpose of this study, the term AW will include both components. AW's operate airborne radar and electronic equipment used in detecting, locating and tracking submarines. They also operate radar to provide information for aircraft and surface ship navigation. Some individuals may also act as helicopter rescue crewmen. They work as part of the flight crew on long range and intermediate range aircraft and on helicopters. Again as with the AX rating, AW's play a key part in a squadron's operation mission effectiveness. Important qualifications for the AW rating include manual dexterity and competence with tools, equipment and machines, good arithmetic and record-keeping ability and the ability to do intricate work and repetitive tasks [Ref. 3].

With the advent of the All Volunteer Force, a projected growth to a 600 ship Navy, increasing costs, both in equipment and in personnel, and a decline in the 17-21 year old male population, the need to study and refine enlistment standards and assignment techniques is obvious [Ref. 4].

A study by Thomason [Ref. 5] indicated that first term attrition among Navy recruits is dependent upon initial rating assignments. This finding, combined with the aforementioned reasons, prove the need for further studies and research in the area of assignment techniques. Better assignment techniques and selection processes should result in lower training costs, improved readiness, higher retention and a more experienced, effective Navy.

## II. DATA BASE DEVELOPMENT

Information on over 206,000 personnel was compiled by merging: (1) the Defense Manpower Data Center (DMDC) Cohort File; (2) a Navy Health Research Center (NHRC) file; (3) a promotional advancement exam file; and (4) a Chief of Naval Education and Training (CNET) file. The DMDC Cohort File contains demographic variables obtained at the time of accession. Additionally, it is updated quarterly with active duty information including information on separation from service if appropriate. Continuously updated, the NHRC file contains medical statistics on personnel from the date of enlistment to date of discharge. The CNET file includes advancement and training information. From this data base, information on 1094 and 559 non-prior service personnel associated with the AW and AX ratings, respectively, was extracted.

By using the Statistical Analysis System (SAS), a number of logic screens were implemented to eliminate data on individuals felt to be inappropriate for analysis because their separation did not reflect failure in the fleet operational environment. Frequency distributions of inter-service separation codes (Tables 1 and 2) provide breakdowns explaining how personnel exited the Navy. Personnel with the following inter-service separation codes were specifically deleted:

<u>Code</u>	<u>Reason for Separation</u>
10	Medical conditions existing prior to service
11	Medical disability with severence pay
12	Permanent medical disability - retired
13	Temporary medical disability - retired
14	Medical disability without severence pay
15	Medical disability - Title 10 retirement
16	Unqualified for active duty - other
22	Dependency or hardship discharge
32	Death
40	Entry into officer commissioning program
41	Entry into warrant officer program
42	Entry into service academy
50	20-30 years of service
94	Pregnancy

As a result of applying the screens, 1048 and 405 AW's and AX's were identified as personnel appropriate for analysis. These groups were placed in separate data sets. One data set includes all personnel who began in the AW rating. Because some AX's were originally classified into an Avionics Technician (AV) rating, the other data set includes those personnel who initially began as AV's and were later classified as AX's as well as those personnel who began as AX's

### III. THE VARIABLES

#### A. BACKGROUND

Current enlistment standards are based jointly on predicted recruit survival rates and on mental aptitudes. In actuality, survival rates have not always been an issue, and not until the early 1970's did mental aptitude start receiving concentrated study [Ref. 6]. Clearly the reason that survivability is being extensively studied for its role in the selection and assignment process of Navy recruits is that by extending a recruit's survivability (reducing attrition), the Navy reduces training and replacement costs, and increases individual and unit performance. Mental aptitude is viewed as a key factor not only in survivability, but also in its role in the individual/skill matching process.

Studies dealing with survivability have analyzed survival rates at recruit training, Class A School, first term of enlistment, and from first through eight years of service [Ref. 7].

Predictor variables used are generally a composite of two or more of the following: (a) the Armed Forces Qualification Test (AFQT) which for ASVAB forms 5, 6, and 7 was a composite score based on three ASVAB subtests - Word Knowledge, Arithmetic Reasoning and Spatial Perception; (b) age; (c) years of education; (d) high school graduation versus non-high school graduation;



(e) high school diploma versus General Equivalency Diploma;  
(f) marital status; (g) number of primary dependents; (h) race;  
(i) sex; (j) residence at time of service entry; (k) location  
of recruit training; (l) rating assigned; and (m) Delayed Entry  
Program (DEP) enlistment.

The following is a summary of a few of the studies on  
enlistment standards and assignment processes.

Lurie [Ref. 8] used AFQT score, number of dependents, and  
years of education to predict the performance of the Ship's  
Serviceman (SH) and Electronics Technician (ETN) ratings. He  
found that for the SH rating, non-high school graduates with  
lower AFQT scores were promoted faster than those with higher  
scores, however AFQT score had no impact on survival. The AFQT  
score did not aid in predicting advancement or survival for  
members of the ETN rating.

Lockman [Ref. 9], in a study to determine the different  
survival rates of Class A School graduates vice non-Class A  
School attendees (GENDETS) found that the Class A School  
graduates with 12 or more years of education had higher survival  
rates than those in the GENDET category with 12 or  
more years of education, but non-school eligible (<50 AFQT  
score), had the higher survival rate. Additional findings  
indicated that the majority of Class A schoolers: (a) had 12  
or more years of education; (b) were school eligible; (c) joined  
the Navy under the Delayed Entry Program (DEP); (d) and survived  
four years of service. The opposite held true for the GENDETS.

Lurie [Ref. 10], in a study of eight year survival rates, found that the most important variable related to survival was educational level. In terms of survival for Class A School attendees, the optimal age was 17 - 21 years old. An interesting finding was that for Class A School attendees, members in mental group I (>90 AFQT) had the worst survival rate. For non-Class A School attendees there was a general upward trend in survival as mental test scores decreased.

In another study by Lockman [Ref. 11] on the effects of joining the Delayed Entry Program (DEP), it was determined that after controlling for recruit quality (as measured by the SCREEN score) and training guarantees, those who were in DEP for three or more months had the highest survival rates.

Thomason [Ref. 12] found in his study on first term enlistment survival rates on 37 different Navy ratings that age, education, DEP enlistment, recruit training location, race, number of dependents, mental group and follow on tour assignments had varying degrees of significance in determining survivability.

Marcus and Lockman [Ref. 13], in their work on analyzing alternative enlistment standards to increase the supply of Navy recruits by improving survivor prediction rates, used a somewhat different approach in their selection of predictor variables. Rather than using the Armed Forces Qualification Test (AFQT), they chose instead to use those ASVAB subtests not included in the computation of the AFQT score, i.e., MK,

MC, EI, AI and SI. The intent was to use different ASVAB subtests in lieu of AFQT when computing a recruit's SCREEN score. The second variable selected was whether or not a recruit required an enlistment waiver and the gravity of the waiver required. The third variable, educational quality, is rather complex in nature, and involved capturing or measuring variations in the quality of high school diplomas and equivalency (GED) tests by geographic region. Finally, the fourth variable selected was Class A School attendance or apprenticeship training.

Their results indicated that no large improvement in survivability prediction would occur from using different ASVAB subtest scores in the SCREEN table. Small increases in supply would occur from expanding somewhat on certain enlistment waivers. Again, increases in supply would occur by adjusting eligibility requirements to allow for measures of GED quality. Lastly, they concluded that separate screening of Class A School and apprenticeship trainees had potential for cost savings to the Navy. The above mentioned increases in supply, of course, relate to the increased numbers recruited by changing the different policies regarding waivers and GEDs.

Lockman and Lurie [Ref. 14], in their work on updating the Navy's Success Chances of Recruits Entering the Navy (SCREEN) table, used a different measure of education and mental aptitude. The SCREEN table in use during their study was based on a composite score of grade of education, whether or not an

applicant had dependents, AFQT score and age. A minimum score of 70 was required for enlistment and the survival predictions were for the first year of service. They replaced highest grade of education with whether an applicant had a high school diploma (or more), certificate of equivalency (GED), or less than high school diploma. AFQT mental group (I, II, III, IV) replaced AFQT score. Results of their study indicated that by replacing the variables the SCREEN table could serve as a predictor of the entire first term of enlistment vice just the first year.

Sands [Ref. 15], in a study to develop an instrument to be used by the Navy recruiters in the field to estimate an applicant's probability of surviving the initial two years of service, used ASVAB aptitude test scores, number of years of education, age and number of dependents as predictor variables. His conclusion was that the model could be used effectively by recruiters and would produce reasonably accurate results.

The above studies, although by no means all inclusive, indicate the key variables used in past research efforts.

#### **B. CRITERION VARIABLES**

This study defines "success" as:

1. completion of 3.9 years of the initial term of enlistment, and
2. achievement of paygrade E-4, and
3. recommendation for reenlistment

"Failure" is achieved in this study if any, or a combination of any, of the following conditions were met:

1. Failure to complete enlistment
2. Failure to be recommended for reenlistment
3. Failure to achieve paygrade E-4

Category 1 in all tables and matrices denotes the "success" category. Category 2 in the various tables and matrices denotes the "failure" category.

These two categories, "success" and "failure", are mutually exclusive but do not account for all of the AW's and AX's in the data set. Twenty-four personnel were excluded from AW analysis and sixteen were excluded from the AX analysis since they fell into a "gray area" in between the two criterion categories.

The measures used in the success category are felt to be valid measures of success for first term enlistment. Even though recruits are enlisted on four or six year contracts, completion of three years and nine months was chosen as a measure of success because the cohort data were updated most recently in October 1982. The three years nine month measure is the longest period some of the 1978 recruits could have achieved. If the four or six year cutoffs had been used as a measure of success, many of those people who enlisted in the last three months of 1978 would have been incorrectly classified as failures.

Actual group membership of the 1976-1978 cohort groups is denoted below:

	Success	Failure
AX	235	154
AW	665	308

### C. PREDICTOR VARIABLES

Predictor variables were selected based on the past research discussed in the Background section of this thesis.

The variables selected were measures of personal attributes that were known at the time of enlistment.

The Navy currently uses SCREEN, AFQT, high school graduation, marital status and age as variables in the enlistment process. Additionally, Class A School eligibility (AFQT >49) and various ASVAB subtest scores are used in skill rating assignment. The ASVAB subtest scores used for the AX and AW ratings are as follows [Ref. 16]:

AX	AW
$MK+EI+GS = 156$	$AR+2MK+GS = 200$
$+AR = 218$	

It should be noted that these formulae involve normed scores, while efforts in this study involve "raw", non-normed scores.

By including Navy's current predictor variables in the analysis, a potential side benefit would be that of analyzing their effectiveness.

Eighteen predictor variables were selected for analysis in this study. Table 3 briefly identifies each variable and provides the number of the table containing the variable's frequency distribution.

#### IV. STATISTICAL TECHNIQUES

The following is a brief description of the statistical procedures used in this analysis.

##### A. FREQUENCY ANALYSIS

Frequency distributions give a count of how frequently each value of the variables occurs among the data sets. In this study, frequency analysis was performed to provide the counts of "success" and "failure" as well as the counts of each predictor variable used in the models. Results are contained in Tables 4 through 21 for the AW's and Tables 22 through 39 for the AX's.

##### B. MULTIVARIATE CORRELATION ANALYSIS

Through the use of this procedure the relationships between and among the variables have been studied. Casual interpretation can not be made safely, but as a descriptive tool correlation analysis has potential for predicting values on one variable given information on another variable or set of variables. A summary measure that communicates the extent of relationship or correlation between a set of predictor variables and a criterion variable is called a multiple correlation coefficient, denoted by  $R$ . The value of the square of the  $R$  signifies the proportion of variance in the criterion variable predicted from the combined set of predictor variables.



### C. STEPWISE REGRESSION

Given a set of predictor variables, it is not necessary to utilize every one in the determination of a multiple R. Rather the stepwise regression procedure chosen begins by selecting the one predictor variable that correlates most highly with the criterion variable, and then introduces a second predictor variable, the one that accounts for the most of the remaining or residual variance in the criterion variable. Variables are continually added until inclusion of another predictor variable would account for only an insignificant amount of variance in the criterion variable.

### D. DISCRIMINANT ANALYSIS

Discriminant analysis is a procedure for identifying whether values on various predictor variables are related to values on a grouped criterion variable. The results present a tabulation of the object's actual group membership versus their predicted group membership [Ref. 17]. In order to predict the probability of membership of each individual observation in one of the criterion groups, discriminant analysis develops a model using the predictor variables shown to have high correlation with the criterion variables. Probability of group membership is assigned based on the model. Individual observations are assigned to the group for which they have the highest probability.

Optionally, discriminant analysis uses a prior probability of group membership when assigning predicted group membership.

(Discriminant Analysis offers the option of assigning either actual or equal values to the prior probabilities of membership in the criterion categories.) Actual probability is obtained by running a frequency distribution on the sample population. Prior knowledge of group membership increases the chance of the discriminant analysis procedure correctly assigning individuals into categories based on new predictor variables. This study uses the actual proportions of success and failure of the sample group. This is felt to be appropriate since this study is trying to improve on the current selection process, and it is realized that all individuals have been screened at the time of their enlistment and were selected based on their meeting the requirements.

## V. MODELS

Two separate models were created for those personnel assigned to the AX and AW ratings. A general discussion of model development for both models will be given followed by a separate in-depth discussion of each model.

From each data base process, two subsets, Deriv8 and Valid8, were developed through random sampling for each rating. For each rating, Deriv8 was used strictly for developing predictor models, and Valid8 was used for validating the models.

A frequency analysis of group membership in the success and failure categories was conducted on both ratings to determine how well Navy's current assignment process was operating. For the AX rating the success rate was 62%, and for the AW rating the success rate was 68.5%. The models developed by this study would have to better these percentages in order to serve as part of an improved assignment process.

In computing the actual models, two basic statistical procedures, stepwise regression and discriminant analysis, were utilized.

### A. AX MODEL

The stepwise regression initially identified four variables that best explained the differences between the success and failure categories: Term of Enlistment, SCREEN, ASVABNO, and

ASVABGI. Of the four variables Term of Enlistment had the highest  $R^2 = .1963$ , meaning that it explained 19.63% of the difference between the two categories (see Table 40). After careful consideration, the authors chose to delete Term of Enlistment as a predictor variable due to the fact that 187 of the 257 observations had initial enlistments for six years and were given automatic advancement to E-4 upon completion of Class A School (see Table 39). Based on these facts, a large number of observations would fall into the success category on the basis of their enlistment contract. Additionally, Term of Enlistment, used in the strict sense of the word, cannot be considered a personal attribute, and is best described as an enlistment choice. The decision processes behind offering four or six year enlistments were not researched.

After Term of Enlistment was deleted from the predictor variables, stepwise regression then selected the following four significant predictor variables: SCREEN, ASVABGI, Entry Paygrade, and ASVABNO (see Table 41). No excessively high correlations among the four variables were observed. Multicollinearity was not deemed to be an issue.

The next step involved running a discriminant analysis on the second set of predictor variables listed above using prior probabilities of 62% and 38%. The results are shown in Table 42.

The positions as shown in the matrix are as follows:

1. (1,1) The number and percentage of successful individuals correctly assigned to the successful category.
2. (1,2) The number and percentage of individuals assigned to the unsuccessful category who were actual successes - "false negatives".
3. (2,1) The number and percentage of unsuccessful individuals incorrectly classified as successful - "false positives".
4. (2,2) The number and percentage of failures correctly classified.

The success of the model can be described by its "hit rate". The total hit rate is the percentage of correct classifications divided by the total number of classifications made. The results produced a hit rate of 66% for the model derivation run and 65% for the validation run.

The results indicate that the model would correctly assign 4% more individuals than the Navy's current assignment process. The model incorrectly classified 72.92% of the unsuccessful individuals as successes.

#### B. AW MODEL

Of the eighteen variables chosen for analysis, the stepwise regression initially identified six predictor variables: Term of Enlistment, SCREEN, ASVABAR, ASVABSP, ASVABSI, and ASVABGS (see Table 43). For the reasons mentioned in the foregoing section, Term of Enlistment was deleted. The subsequent stepwise regression yielded the following four predictor variables: SCREEN, ASVABAR, ASVABMK, and Entry

Paygrade. There were no significantly high sample correlations between the variables, thus multicollinearity was again not an issue. The results are shown in Table 44.

The model produced a hit rate of 69% (Table 45). When compared to Navy's current success rate of 68.5%, negligible improvement was attained. This model incorrectly classified 99% of the unsuccessful individuals as successes.

#### C. ADDENDUM

As a matter of interest, the following results of using Term of Enlistment as a predictor variable for the two models are provided for possible use in future analysis.

#### AX MODEL WITH TERM OF ENLISTMENT, SCREEN, ASVABNO and ASVABGI

Hit rate: Model 76%      Validation 75%  
(correctly assigned failures 69.58% of the time)  
(Table 46)

#### AW MODEL WITH TERM OF ENLISTMENT, SCREEN, ASVABSP, ASVABAR, ASVABSI, and ASVABGS

Hit rate: Model 75%      Validation 73%  
(correctly assigned failures 64.88% of the time)  
(Table 47)

The hit rates and failure classification rates appear attractive as the hit rates are 13% and 6.5% higher for the AX and AW ratings, respectively, than the Navy's. It is emphasized

that the authors are of the opinion that unless the effects of six year enlistments and automatic advancements to E-4 are controlled for, the results are not useful.

## VI. CONCLUSIONS

The results obtained from both AX and AW models, when Term of Enlistment is not considered, offer a certain amount of improvement over the Navy's current assignment process. In the case of the AX model developed in this analysis, a 4% increase over the Navy's assignment process would translate into substantial savings. To a lesser degree the same would be true for the .5% increase with the AW model. Of concern though is the false success assignment rate produced by both models. If the benefits in terms of cost and utility are higher by correctly assigning individuals into the AW and AX ratings than they are to incorrectly assigning them, then this analysis might lend support to modify current AX and AW assignment standards. Further study in the areas of cost and utility analysis is recommended. Such an analysis should also consider the costs and utilities of correct rejections and wrong rejections.

The benefit of this analysis is that given the information at the time of enlistment and the definition of success used in this study, it was shown that an improvement can be made to the AW and AX assignment process. The AX model used ASVABGI and ASVABNO vice those currently used by the Navy (MK, EI, GS and AR). A suggested follow on study would be to analyze the effects of using different combinations of the ASVAB subtests.



The AW model lent support to the Navy's assignment process in that it used two of the same variables, i.e., ASVABAR and ASVABMK, the Navy currently uses (AR, MK and GS).

The role of Term of Enlistment in predicting success in the assignment process deserves further analysis. A suggested method would be to separate those individuals with different enlistment obligations and run an analysis similar to the one used in this study to see how, or if, the people who enlist for different lengths of service differ in variables predictive of success in the Navy.

As noted by Whitmire and Deitchman [Ref. 18], the data base available for this analysis did not include those individuals who were rejected in the current assignment process. Therefore, we do not know the Navy's current wrong-rejection rate. Only those personnel who were actually assigned to the rating were available for analysis. This leaves open the possibility that more accurate screening tools could have been used initially. And, had those rejected been available, the results of this analysis may have been different.

TABLE 1  
INTER-SERVICE SEPARATION CODE FOR THE AW RATING

ISC3	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	395	395	36.106	36.106
1	526	921	48.090	84.186
2	1	922	0.091	84.278
8	14	936	1.280	85.558
10	13	949	1.188	86.746
11	4	953	0.366	87.112
13	5	958	0.457	87.569
16	1	959	0.091	87.660
32	7	966	0.640	88.300
40	15	981	1.371	89.671
50	1	982	0.091	89.762
60	13	995	1.188	90.951
61	1	996	0.091	91.042
63	2	998	0.183	91.225
64	4	1002	0.366	91.590
65	23	1025	2.102	93.693
67	3	1028	0.274	93.967
71	2	1030	0.183	94.150
73	6	1036	0.548	94.698
74	2	1038	0.183	94.881
75	1	1039	0.091	94.973
76	2	1041	0.183	95.155
78	7	1048	0.640	95.795
80	1	1049	0.091	95.887
82	3	1052	0.274	96.161
86	12	1064	1.097	97.258
87	1	1065	0.091	97.349
91	15	1080	1.371	98.720
95	1	1081	0.091	98.812
96	1	1082	0.091	98.903
98	7	1089	0.640	99.543
99	5	1094	0.457	100.000

TABLE 2  
INTER-SERVICE SEPARATION CODE FOR AX RATING

ISC3	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	257	257	45.975	45.975
1	237	494	42.397	88.372
2	1	495	0.179	88.551
8	10	505	1.789	90.340
10	3	508	0.537	90.877
11	2	510	0.358	91.234
13	2	512	0.358	91.592
22	6	518	1.073	92.665
32	4	522	0.716	93.381
40	1	523	0.179	93.560
60	8	531	1.431	94.991
61	1	532	0.179	95.170
63	1	533	0.179	95.349
64	1	534	0.179	95.528
65	6	540	1.073	96.601
67	1	541	0.179	96.780
71	1	542	0.179	96.959
73	3	545	0.537	97.496
76	2	547	0.358	97.853
78	2	549	0.358	98.211
82	5	554	0.894	99.106
86	1	555	0.179	99.284
90	1	556	0.179	99.463
91	1	557	0.179	99.642
9	2	559	0.358	100.000

TABLE 3  
PREDICTOR VARIABLES

VARIABLE	AW table	AX table
ASVABGI (General Intelligence)	4	22
ASVABNO (Numerical Operations)	5	23
ASVABAD (Attention to Detail)	6	24
ASVABWK (Word Knowledge)	7	25
ASVABAR (Arithmetic Reasoning)	8	26
ASVABSP (Spatial Perception)	9	27
ASVABMK (Mathematical Knowledge)	10	28
ASVABEI (Electronics Intelligence)	11	29
ASVABMC (Mechanical Comprehension)	12	30
ASVABGS (General Science)	13	31
ASVABSI (Shop Information)	14	32
ASVABAI (Automotive Information)	15	33
SCREEN (Success Chances for Recruits Entering the Navy)	16	34
RACE (1=Caucasian, 2=Black, 3=Other)	17	35
ENTRY PAYGRADE (E1-3)	18	36
MARITAL DEPENDENTS (# of dependents and marital status)	19	37
AFQT PERCENTILE (Based on ASVAB subtests WK, AR, SP)	20	38
TERM OF ENLISTMENT (Number of years service)	21	39

TABLE 4

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE GI

ASVABGI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.133	0.133
2	1	3	0.091	0.274
4	3	6	0.274	0.548
5	3	9	0.274	0.823
6	13	22	1.188	2.011
7	22	44	2.011	4.022
8	50	94	4.570	8.592
9	75	169	6.856	15.448
10	113	282	10.329	25.777
11	160	442	14.625	40.402
12	201	643	18.373	58.775
13	216	859	19.744	78.519
14	176	1035	16.088	94.607
15	59	1094	5.393	100.000

TABLE 5

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE NO

ASVABNO	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
6	2	4	0.183	0.366
9	1	5	0.091	0.457
13	2	7	0.183	0.640
14	2	9	0.183	0.823
15	3	12	0.274	1.097
16	1	13	0.091	1.188
17	3	16	0.274	1.463
18	1	17	0.091	1.554
19	9	26	0.823	2.377
20	9	35	0.823	3.199
21	11	46	1.005	4.205
22	12	58	1.097	5.302
23	13	71	1.188	6.490
24	19	90	1.737	8.227
25	13	103	1.188	9.415
26	24	127	2.194	11.609
27	29	156	2.651	14.260
28	30	186	2.742	17.002
29	37	223	3.382	20.384
30	55	278	5.027	25.411
31	58	336	5.302	30.713
32	55	391	5.027	35.740
33	55	446	5.027	40.768
34	64	510	5.850	46.618
35	62	572	5.667	52.285
36	44	616	4.022	56.307
37	60	676	5.484	61.792
38	49	725	4.479	66.271
39	44	769	4.022	70.293
40	49	818	4.479	74.771
41	25	843	2.285	77.057
42	42	885	3.839	80.896
43	41	926	3.748	84.644
44	19	945	1.737	86.380
45	23	968	2.102	88.483
46	31	999	2.834	91.316
47	21	1020	1.920	93.236
48	20	1040	1.828	95.064
49	22	1062	2.011	97.075
50	32	1094	2.925	100.000

TABLE 6

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AD

ASVABAD	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
3	1	3	0.091	0.274
5	2	5	0.183	0.457
6	3	8	0.274	0.731
7	9	17	0.823	1.554
8	12	29	1.097	2.651
9	25	54	2.285	4.936
10	44	98	4.022	8.958
11	56	154	5.119	14.077
12	97	251	8.867	22.943
13	125	376	11.426	34.369
14	116	492	10.603	44.973
15	138	630	12.614	57.587
16	111	741	10.146	67.733
17	102	843	9.324	77.057
18	92	935	8.410	85.466
19	57	992	5.210	90.676
20	31	1023	2.834	93.510
21	32	1055	2.925	96.435
22	18	1073	1.645	98.080
23	8	1081	0.731	98.812
24	7	1088	0.640	99.452
25	3	1091	0.274	99.726
26	2	1093	0.183	99.909
28	1	1094	0.091	100.000

TABLE 7

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE WK

ASVABWK	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
6	1	3	0.091	0.274
9	1	4	0.091	0.366
13	2	6	0.183	0.548
14	2	8	0.183	0.731
15	4	12	0.366	1.097
16	11	23	1.005	2.102
17	13	36	1.188	3.291
18	18	54	1.645	4.936
19	33	87	3.016	7.952
20	48	135	4.388	12.340
21	47	182	4.296	16.636
22	60	242	5.484	22.121
23	80	322	7.313	29.433
24	103	425	9.415	38.848
25	94	519	8.592	47.441
26	119	638	10.878	58.318
27	129	767	11.792	70.110
28	114	881	10.420	80.530
29	116	997	10.603	91.133
30	97	1094	8.867	100.000



TABLE 8

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AR

ASVABAR	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
2	2	4	0.183	0.366
7	1	5	0.091	0.457
8	3	8	0.274	0.731
9	9	17	0.823	1.554
10	24	41	2.194	3.748
11	36	77	3.291	7.038
12	54	131	4.936	11.974
13	76	207	5.947	18.921
14	118	325	10.786	29.707
15	147	472	13.437	43.144
16	160	632	14.625	57.770
17	137	769	12.523	70.293
18	136	905	12.431	82.724
19	112	1017	10.238	92.962
20	77	1094	7.038	100.000

TABLE 9

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE SP

ASVABSP	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	3	3	0.274	0.274
3	2	5	0.183	0.457
4	4	9	0.366	0.823
5	5	14	0.457	1.280
6	9	23	0.823	2.102
7	19	42	1.737	3.839
8	46	88	4.205	8.044
9	52	140	4.753	12.797
10	53	193	4.845	17.642
11	93	286	8.501	26.143
12	104	390	9.506	35.649
13	103	493	9.415	45.064
14	93	586	8.501	53.565
15	118	704	10.786	64.351
16	106	810	9.689	74.040
17	107	917	9.781	83.821
18	66	983	6.033	89.854
19	66	1049	6.033	95.887
20	45	1094	4.113	100.000

TABLE 10

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE MK

ASVABMK	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
3	1	3	0.091	0.274
4	1	4	0.091	0.366
5	3	7	0.274	0.640
6	14	21	1.280	1.920
7	15	36	1.371	3.291
8	28	64	2.559	5.850
9	41	105	3.748	9.598
10	50	155	4.570	14.168
11	70	225	6.399	20.567
12	88	313	8.044	28.611
13	112	425	10.238	38.848
14	106	531	9.689	48.537
15	102	633	9.324	57.861
16	103	736	9.415	67.276
17	93	829	8.501	75.777
18	98	927	8.958	84.735
19	88	1015	8.044	92.779
20	79	1094	7.221	100.000

TABLE 11

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE EI

ASVABEI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
6	2	4	0.183	0.366
7	2	6	0.183	0.548
9	4	10	0.366	0.914
10	4	14	0.366	1.280
11	3	17	0.274	1.554
12	7	24	0.640	2.194
13	13	37	1.188	3.382
14	19	56	1.737	5.119
15	25	81	2.285	7.404
16	37	118	3.382	10.786
17	56	174	5.119	15.905
18	55	229	5.027	20.932
19	71	300	6.490	27.422
20	88	388	8.044	35.466
21	101	489	9.232	44.698
22	102	591	9.324	54.022
23	115	706	10.512	64.534
24	99	805	9.049	73.583
25	89	894	8.135	81.718
26	72	966	6.581	88.300
27	55	1021	5.027	93.327
28	38	1059	3.473	96.801
29	22	1081	2.011	98.812
30	13	1094	1.188	100.000

TABLE 12

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE MC

ASVABMC	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
4	4	6	0.366	0.548
5	6	12	0.548	1.097
6	16	28	1.463	2.559
7	35	63	3.199	5.759
8	34	97	3.108	8.867
9	57	154	5.210	14.077
10	87	241	7.952	22.029
11	92	333	8.410	30.439
12	101	434	9.232	39.671
13	125	559	11.426	51.097
14	128	687	11.700	62.797
15	107	794	9.781	72.578
16	108	902	9.872	82.450
17	78	980	7.130	89.580
18	71	1051	6.490	96.069
19	33	1084	3.016	99.086
20	10	1094	0.914	100.000

TABLE 13

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE GS

ASVABGS	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.183	0.183
2	2	4	0.183	0.366
4	2	6	0.183	0.548
6	9	15	0.823	1.371
7	18	33	1.645	3.016
8	18	51	1.645	4.662
9	35	86	3.199	7.861
10	64	150	5.850	13.711
11	93	243	8.501	22.212
12	95	338	8.684	30.896
13	130	468	11.883	42.779
14	136	604	12.431	55.210
15	119	723	10.878	66.088
16	117	840	10.695	76.782
17	107	947	9.781	86.563
18	89	1036	8.135	94.698
19	39	1075	3.565	98.263
20	19	1094	1.737	100.000

TABLE 14

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE SI

ASVABSI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	16	16	1.463	1.463
2	2	18	0.183	1.645
5	1	19	0.091	1.737
6	4	23	0.366	2.102
7	9	32	0.823	2.925
8	10	42	0.914	3.839
9	16	58	1.463	5.302
10	49	107	4.479	9.781
11	39	146	3.565	13.346
12	55	201	5.027	18.373
13	98	299	8.958	27.331
14	108	407	9.872	37.203
15	111	518	10.146	47.349
16	137	655	12.523	59.872
17	139	794	12.706	72.578
18	123	917	11.243	83.821
19	114	1031	10.420	94.241
20	63	1094	5.759	100.000

TABLE 15

AW ASVAB APTITUDE AREA SCORE -- SUBSCALE AI

ASVABAI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	17	17	1.554	1.554
2	1	18	0.091	1.645
3	2	20	0.183	1.828
4	10	30	0.914	2.742
5	5	35	0.457	3.199
6	19	54	1.737	4.936
7	38	92	3.473	8.410
8	66	158	6.033	14.442
9	54	212	4.936	19.378
10	71	283	6.490	25.868
11	89	372	8.135	34.004
12	100	472	9.141	43.144
13	97	569	8.867	52.011
14	90	659	8.227	60.238
15	88	747	8.044	68.282
16	89	836	8.135	76.417
17	60	896	5.484	81.901
18	81	977	7.404	89.305
19	77	1054	7.038	96.344
20	40	1094	3.656	100.000



TABLE 16  
AW SCREEN SCORE

SCREEN	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
.	43	.	.	.
66	6	6	0.571	0.571
68	2	8	0.190	0.761
70	3	16	0.761	1.522
72	8	24	0.751	2.284
74	28	52	2.664	4.948
76	9	61	0.856	5.804
77	22	83	2.093	7.897
78	35	118	3.330	11.227
79	60	178	5.709	16.936
80	1	179	0.095	17.031
81	39	218	3.711	20.742
82	71	289	6.755	27.498
83	18	307	1.713	29.210
84	40	347	3.806	33.016
86	25	373	2.474	35.490
87	93	466	8.849	44.339
88	144	610	13.701	58.040
89	49	659	4.652	62.702
90	323	982	30.733	93.435
91	2	984	0.190	93.625
92	17	1001	1.618	95.243
93	13	1014	1.237	96.480
94	2	1016	0.190	96.670
95	31	1047	2.950	99.619
96	4	1051	0.381	100.000

TABLE 17

## AW RACE DISTRIBUTION

RACE	(1) WHITE, FREQUENCY	(2) BLACK, CUM FREQ	(3) OTHER PERCENT	CUM PERCENT
1	1048	1048	95.795	95.795
2	38	1086	3.473	99.269
3	8	1094	0.731	100.000

TABLE 18

## AW ENTRY PAY GRADE (E00-011)

ENTR PAYG	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
1	812	812	74.223	74.223
2	151	963	13.803	88.026
3	131	1094	11.974	100.000

TABLE 19

## AW MARITAL STATUS/DEPENDENTS

MRTLDPND	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
10	1051	1051	96.069	96.069
11	4	1055	0.366	96.435
12	2	1057	0.183	96.618
21	24	1081	2.194	98.812
22	12	1093	1.097	99.909
24	1	1094	0.091	100.000

TABLE 20

## AW AFQT SCORE FREQUENCY

AFQTPCNT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	2	2	0.193	0.183
12	1	3	0.091	0.274
17	1	4	0.091	0.366
19	1	5	0.091	0.457
23	2	7	0.193	0.640
27	2	9	0.183	0.823
29	1	10	0.091	0.914
31	3	13	0.274	1.188
33	3	16	0.274	1.463
35	9	25	0.823	2.285
38	6	31	0.548	2.834
41	11	42	1.005	3.839
44	17	59	1.554	5.393
47	16	75	1.463	6.856
50	23	98	2.102	8.958
53	29	127	2.651	11.609
56	42	169	3.839	15.448
58	50	219	4.570	20.018
60	58	277	5.302	25.320
62	65	342	5.941	31.261
65	58	400	5.302	36.563
67	79	479	7.221	43.784
70	68	547	6.216	50.000
72	51	598	4.662	54.662
75	68	666	6.216	60.878
77	51	717	4.662	65.539
80	53	770	4.845	70.384
82	66	836	6.033	76.417
84	46	882	4.235	80.622
86	44	926	4.022	84.644
87	34	960	3.108	87.751
89	34	994	3.108	90.859
91	20	1014	1.828	92.687
93	23	1037	2.102	94.790
95	24	1061	2.194	96.984
97	13	1074	1.188	98.172
98	9	1083	0.823	98.995
99	11	1094	1.005	100.000

TABLE 21

AW TERM OF ENLISTMENT (NO. OF YEARS)

TERMENLT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
2	4	4	0.366	0.366
4	657	661	60.055	60.420
6	433	1094	39.560	100.000

TABLE 22

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE GI

ASVABGI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
2	2	2	0.358	0.358
5	4	6	0.716	1.073
6	8	14	1.431	2.504
7	8	22	1.431	3.936
8	18	40	3.220	7.156
9	42	82	7.513	14.669
10	63	145	11.270	25.939
11	57	212	11.986	37.925
12	113	325	20.215	58.140
13	110	435	19.678	77.818
14	85	520	15.206	93.023
15	39	559	6.977	100.000

TABLE 23

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE NO

ASVABNO	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
7	1	1	0.179	0.179
13	1	2	0.179	0.358
15	1	3	0.179	0.537
16	1	4	0.179	0.716
17	2	6	0.358	1.073
18	3	9	0.537	1.610
19	1	10	0.179	1.789
20	4	14	0.716	2.504
21	5	19	0.894	3.399
22	5	24	0.894	4.293
23	9	33	1.610	5.903
24	8	41	1.431	7.335
25	12	53	2.147	9.481
26	12	65	2.147	11.628
27	22	87	3.936	15.564
28	18	105	3.220	18.784
29	21	126	3.757	22.540
30	22	148	3.936	26.476
31	13	161	2.326	28.801
32	38	199	5.798	35.599
33	22	221	3.936	39.535
34	30	251	5.367	44.902
35	17	268	3.041	47.943
36	29	297	5.188	53.131
37	30	327	5.367	58.497
38	30	357	5.367	63.864
39	29	386	5.188	69.052
40	25	411	4.472	73.524
41	26	437	4.651	78.175
42	19	456	3.399	81.574
43	16	472	2.862	84.436
44	15	487	2.683	87.120
45	11	498	1.968	89.088
46	12	510	2.147	91.234
47	12	522	2.147	93.381
48	9	531	1.610	94.991
49	12	543	2.147	97.138
50	16	559	2.852	100.000

TABLE 24

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AD

ASVABAD	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
3	1	1	0.179	0.179
4	1	2	0.179	0.358
5	1	3	0.179	0.537
6	1	4	0.179	0.716
7	2	5	0.358	1.073
8	11	17	1.968	3.041
9	13	30	2.326	5.367
10	22	52	3.936	9.302
11	31	83	5.546	14.848
12	50	133	8.945	23.792
13	49	182	8.756	32.558
14	70	252	12.522	45.081
15	60	312	10.733	55.814
16	66	378	11.807	67.621
17	43	421	7.592	75.313
18	41	462	7.335	82.648
19	32	494	5.725	88.372
20	19	513	3.399	91.771
21	17	530	3.041	94.812
22	11	541	1.968	96.780
23	6	547	1.073	97.853
24	6	553	1.073	98.927
25	3	556	0.537	99.463
26	3	559	0.537	100.000

TABLE 25

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE WK

ASVABWK	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
5	1	1	0.179	0.179
8	1	2	0.179	0.358
12	3	5	0.537	0.894
14	2	7	0.358	1.252
15	3	10	0.537	1.789
16	5	15	0.894	2.683
17	7	22	1.252	3.936
18	12	34	2.147	6.082
19	17	51	3.041	9.123
20	18	69	3.220	12.343
21	32	101	5.725	18.068
22	34	135	6.082	24.150
23	31	166	5.546	29.696
24	40	206	7.156	36.852
25	45	251	8.050	44.902
26	48	299	8.587	53.488
27	60	359	10.733	64.222
28	68	427	12.165	76.386
29	63	490	11.270	87.657
30	69	559	12.343	100.000

TABLE 26

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AR

ASVABAR	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
6	1	1	0.179	0.179
8	1	2	0.179	0.358
9	3	5	0.537	0.894
10	5	10	0.894	1.789
11	10	20	1.789	3.578
12	23	43	4.114	7.692
13	26	69	4.651	12.343
14	43	112	7.692	20.036
15	47	159	8.408	28.444
16	74	233	13.238	41.682
17	103	336	18.426	60.107
18	82	418	14.669	74.776
19	73	491	13.059	87.835
20	68	559	12.165	100.000



TABLE 27

## AX ASVAB APTITUDE AREA SCORE - SUBSCALE SP

ASVABSP	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
4	1	1	0.179	0.179
5	2	3	0.358	0.537
6	5	8	0.894	1.431
7	12	20	2.147	3.578
8	8	28	1.431	5.009
9	19	47	3.399	8.408
10	28	75	5.009	13.417
11	25	100	4.472	17.889
12	34	134	6.082	23.971
13	46	180	8.229	32.200
14	56	236	10.018	42.218
15	54	290	9.650	51.878
16	56	346	10.018	61.896
17	65	411	11.628	73.524
18	63	474	11.270	84.794
19	53	527	9.431	94.275
20	32	559	5.725	100.000

TABLE 28

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE MK

ASVABMK	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
7	1	1	0.179	0.179
8	3	4	0.537	0.716
9	9	13	1.610	2.326
10	8	21	1.431	3.757
11	22	43	3.936	7.692
12	18	61	3.220	10.912
13	27	88	4.830	15.742
14	40	128	7.156	22.898
15	63	196	12.165	35.063
16	72	268	12.890	47.943
17	89	356	15.742	63.685
18	72	428	12.890	76.565
19	77	505	13.775	90.340
20	54	559	9.660	100.000

TABLE 29

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE EI

ASVABEI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
11	1	1	0.179	0.179
13	1	2	0.179	0.358
14	2	4	0.358	0.716
16	6	10	1.073	1.789
17	5	15	0.894	2.683
18	10	25	1.789	4.472
19	19	44	3.399	7.871
20	33	77	5.903	13.775
21	32	109	5.725	19.499
22	35	144	6.261	25.760
23	64	208	11.449	37.209
24	44	252	7.871	45.081
25	61	313	10.912	55.993
26	79	392	14.132	70.125
27	64	456	11.449	81.574
28	49	505	8.766	90.340
29	35	540	6.261	96.601
30	19	559	3.399	100.000

TABLE 30

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE MC

ASVABMC	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
4	2	2	0.358	0.358
5	1	3	0.179	0.537
7	6	9	1.073	1.610
8	9	18	1.610	3.220
9	13	31	2.326	5.546
10	29	60	5.188	10.733
11	44	104	7.871	18.605
12	43	147	7.692	26.297
13	59	206	10.555	36.852
14	62	268	11.091	47.943
15	63	331	11.270	59.213
16	67	398	11.986	71.199
17	61	459	10.912	82.111
18	59	518	10.555	92.665
19	28	546	5.009	97.674
20	13	559	2.326	100.000

TABLE 31

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE GS

ASVABGS	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
8	2	2	0.358	0.358
9	5	7	0.894	1.252
10	7	14	1.252	2.504
11	20	34	3.578	6.082
12	32	66	5.725	11.807
13	64	130	11.449	23.256
14	70	200	12.522	35.778
15	76	276	13.596	49.374
16	91	367	16.279	65.653
17	83	450	14.848	80.501
18	53	503	9.481	89.982
19	40	543	7.156	97.138
20	16	559	2.862	100.000

TABLE 32

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE SI

ASVABSI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	6	6	1.073	1.073
3	1	7	0.179	1.252
5	1	8	0.179	1.431
8	5	13	0.894	2.326
9	5	18	0.894	3.220
10	16	34	2.862	6.082
11	14	48	2.504	8.587
12	17	65	3.041	11.628
13	26	91	4.651	16.279
14	46	137	8.229	24.508
15	45	182	8.050	32.558
16	65	247	11.628	44.186
17	82	329	14.669	58.855
18	101	430	18.068	76.923
19	81	511	14.490	91.413
20	48	559	8.587	100.000

TABLE 33

AX ASVAB APTITUDE AREA SCORE -- SUBSCALE AI

ASVABAI	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
0	6	6	1.073	1.073
4	2	8	0.358	1.431
5	6	14	1.073	2.504
6	5	19	0.894	3.399
7	8	27	1.431	4.830
8	13	40	2.326	7.156
9	23	63	4.114	11.270
10	28	91	5.009	16.279
11	42	133	7.513	23.792
12	33	166	5.903	29.696
13	41	207	7.335	37.030
14	51	258	9.123	46.154
15	45	303	8.050	54.204
16	41	344	7.335	61.538
17	64	408	11.449	72.987
18	54	462	9.660	82.648
19	60	522	10.733	93.381
20	37	559	6.619	100.000

TABLE 34  
AX SCREEN SCORE

SCREEN	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
.	36	.	.	.
66	6	6	1.147	1.147
70	6	12	1.147	2.294
72	2	14	0.382	2.677
74	6	20	1.147	3.824
76	5	25	0.956	4.780
77	4	29	0.755	5.545
78	21	50	4.015	9.560
79	15	65	2.858	12.428
81	5	70	0.956	13.384
82	55	125	10.516	23.901
83	8	133	1.530	25.430
84	10	143	1.912	27.342
86	23	166	4.398	31.740
87	48	214	9.178	40.918
88	60	274	11.472	52.390
89	24	298	4.589	56.979
90	179	477	34.226	91.205
91	1	478	0.191	91.396
92	10	488	1.912	93.308
93	10	498	1.912	95.220
94	1	499	0.191	95.411
95	22	521	4.207	99.618
96	2	523	0.382	100.000



TABLE 35

## AX RACE DISTRIBUTION

(1) WHITE, (2) BLACK, (3) OTHER				
RACE	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
1	529	529	94.633	94.633
2	20	549	3.578	98.211
3	10	559	1.789	100.000

TABLE 36

## AX ENTRY PAY GRADE (E00-011)

ENTRPAIG	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
1	280	280	50.089	50.089
2	35	315	6.261	56.351
3	243	558	43.470	99.821
6	1	559	0.179	100.000

TABLE 37

## AX MARITAL STATUS/DEPENDENTS

MRTLPND	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
10	520	520	93.023	93.023
11	5	525	0.894	93.918
12	4	529	0.716	94.633
14	1	530	0.179	94.812
20	1	531	0.179	94.991
21	19	550	3.399	98.390
22	8	558	1.431	99.821
23	1	559	0.179	100.000

TABLE 38

AX AFQT PERCENTILE (OR EQUIVALENT)

AFQTPCNT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
17	1	1	0.179	0.179
23	1	2	0.179	0.358
25	1	3	0.179	0.537
27	1	4	0.179	0.716
29	1	5	0.179	0.894
31	2	7	0.358	1.252
33	1	8	0.179	1.431
35	1	9	0.179	1.610
38	5	14	0.894	2.504
41	5	19	0.894	3.399
44	4	23	0.716	4.114
47	4	27	0.716	4.830
50	6	33	1.073	5.903
53	9	42	1.610	7.513
56	11	53	1.968	9.481
58	28	81	5.009	14.490
60	19	100	3.399	17.889
62	18	118	3.220	21.109
65	25	143	4.472	25.581
67	29	172	5.188	30.769
70	33	205	5.903	36.673
72	32	237	5.725	42.397
75	22	259	3.936	46.333
77	33	292	5.903	52.236
80	36	328	6.440	58.676
82	26	354	4.651	63.327
84	34	388	6.082	69.410
86	18	406	3.220	72.630
87	34	440	6.082	78.712
89	32	472	5.725	84.436
91	21	493	3.757	88.193
93	20	513	3.578	91.771
95	18	531	3.220	94.991
97	14	545	2.504	97.496
98	10	555	1.789	99.284
99	4	559	0.716	100.000

TABLE 39

## AX TERM OF ENLISTMENT (NO. OF YEARS)

TERMENLT	FREQUENCY	CUM FREQ	PERCENT	CUM PERCENT
2	1	1	0.179	0.179
4	371	372	66.369	66.547
6	187	559	33.453	100.000

TABLE 40

AX STEPWISE SELECTION: SUMMARY  
TERMENLT AS A VARIABLE

Variable Entered	Number In	Partial R**2	F StatF	Prob
TERMENLT	1	0.1963	61.538	0.0001
SCREEN	2	0.0229	5.878	0.0160
ASVABNO	3	0.0169	4.289	0.0394
ASVABGI	4	0.0095	2.395	0.1230

TABLE 41

AX STEPWISE SELECTION: SUMMARY  
WITHOUT TERMENLT

VARIABLES Entered	Number In	Partial R**2	F Stat	Prob F
SCREEN	1	0.0304	7.898	0.0053
ASVABGI	2	0.0207	5.303	0.0221
ENTRPAYG	3	0.0139	3.526	0.0616
ASVSABNO	4	0.0090	2.266	0.1335

TABLE 42

## AX DISCRIMINANT ANALYSIS

## Deriv8 WITHOUT TERMENLT

From C1	1	2	Total
.	12 100.0	0 0.0	12 100.0
1	156 92.31	13 7.69	169 100.0
2	76 72.38	29 27.62	105 100.0
Total Percent	244 85.31	42 14.69	286 100.0
Priors	0.6168	0.3832	

## Valid8 WITHOUT TERMENLT

From c1	1	2	Total
.	3 75.00	1 25.00	4 100.0
1	58 87.88	8 12.12	66 100.0
2	39 79.59	10 20.41	49 100.0
Total Percent	100 84.03	19 15.97	119 100.0
Priors	0.6168	0.3832	

TABLE 43

AW STEPWISE SELECTION: SUMMARY  
WITH TERMENLT

Variable Entered	Number In	Partial R**2	F Stat	Prob F
TERMENLT	1	0.1881	150.373	0.0001
SCREEN	2	0.0064	4.190	0.0411
ASVABAR	3	0.0061	3.982	0.0464
ASVABSP	4	0.0037	2.422	0.1202
ASVABSI	5	0.0035	2.270	0.1324
ASVABGS	6	0.0039	2.499	0.1144

TABLE 44

AW STEPWISE SELECTION: SUMMARY  
WITHOUT TERMENLT

Variable Entered	Number In	Partial R**2	F Stat	Prob F
SCREEN	1	0.0158	10.451	0.0013
ASVABAR	2	0.0072	4.723	0.0301
ASVABMK	3	0.0060	3.880	0.493
ENTRPAVG	4	0.0043	2.791	0.0953

TABLE 45

## AW DISCRIMINANT ANALYSIS

## Deriv8 WITHOUT TERMENLT

C1	1	2	Total
.	100.0	0.0	100.0
1	439 98.43	7 1.57	446 100.0
2	193 94.15	12 5.85	205 100.0
Total	652	19	671
Percent	97.17	2.83	100.0
Priors	0.6851	0.3149	

## Valid8 WITHOUT TERMENLT

C1	1	2	Total
.	13 100.0	0 00.0	13 100.0
1	217 99.09	2 .91	219 100.0
2	100 97.09	3 2.91	103 100.0
Total	330	5	335
Percent	98.51	1.49	100.0
Priors	0.6851	0.3149	

TABLE 46

## AX DISCRIMINANT ANALYSIS

## Deriv8 TERMENLT AS A VARIABLE

From	1	2	Total
C1	7	5	12
.	58.33	41.67	100.0
1	130	28	158
	82.28	17.72	100.0
2	34	62	96
	35.42	64.58	100.0
Total	171	95	266
Percent	64.29	35.71	100.0
Priors	.6220	.3780	

## Valid8 TERMENLT AS A VARIABLE

From	1	2	Total
C1	0	4	4
.	00.0	100.00	100.0
1	47	15	62
	75.81	24.19	100.0
2	12	33	45
	26.67	73.33	100.0
Total	59	52	111
Percent	53.15	46.85	100.0
Priors	.6220	.3780	

TABLE 47

## AW DISCRIMINANT ANALYSIS

## Deriv8 TERMENLT AS A VARIABLE

From C1	1	2	Total
.	11 55.0	9 45.0	20 100.0
1	355 79.60	91 20.40	446 100.0
2	72 35.12	133 64.88	205 100.0
Total Percent	430 65.28	233 34.72	671 100.0
Priors	0.6851	0.3144	

## Valid8 TERMENLT AS A VARIABLE

From C1	1	2	Total
.	4 30.77	9 69.23	13 100.0
1	173 79.00	46 21.00	219 100.0
2	43 41.75	60 58.25	103 100.0
Total Percent	220 65.67	115 34.33	335 100.0
Priors	0.6851	0.3149	



## LIST OF REFERENCES

1. Vinberg, Robert and Joyner, John N., Prediction of Job Performance: Review of Military Studies (NPRDC TR 82-37), Navy Personnel Research and Development Center, 1982.
2. Navy Enlisted Career Guide, 1980-1981.
3. Ibid., p. 66.
4. Binkin, Martin and Back, Shirley J., Women and the Military, The Brookings Institution, 1977.
5. Thomason, James S., First Term Survival and Reenlistment Changes for Navy Ratings and a Strategy for Their Use, 1979.
6. Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), ASVAB Working Group History of the Armed Forces Vocational Aptitude Battery (ASVAB) 1974-1980, Washington, DC, 1980.
7. Lurie, Philip M., Continuous Estimates of Survival Through Eight Years of Service Using FY 1979 Cross-Sectional Data, 1981.
8. Lurie, Philip M., Relating Enlistment Standards to Job Performance: A Pilot Study for Two Navy Ratings, 1981.
9. Lockman, Robert F., First Term Success Predictions for Class A School and General Detail Recruits, 1978.
10. Lurie, p. 56.
11. Lockman, Robert F., The Effect of Delayed Entry, Recruit Quality and Training Guarantees of Two-Year Survival of Navy Enlisted Men, 1976.
12. Thomason, p. 35.
13. Marcus, Alan J., and Lockman, Robert F., Alternative Enlistment Standards, 1981.
14. Lockman, Robert F. and Lurie, Philip M., A New Look at Success Chances for Recruits Entering the Navy (SCREEN), 1980.

15. Sands, William A., Screening Male Applicants for Navy Enlistment (NPRDC TR 77-34), Navy Personnel Research and Development Center, San Diego, 1977.
16. Navy Enlisted Recruiting Manual.
17. Kachigan, Sam K., Multivariate Statistical Analysis A Conceptual Introduction, New York, 1982.
18. Whitmire, Robert D. and Deitchman, Charles G., An Enlisted Performance Prediction Model for the Aviation Structural Mechanics, M.S. Thesis, Naval Postgraduate School, 1983.

## BIBLIOGRAPHY

Bachman, Jerald G., American High School Seniors View the Military, 1976-1982, University of Michigan, 1982.

Cory, Charles H., Predictive Validity of Surrogate Measures of Job Performance for Navy GENDETS, Navy Personnel Research and Development Center, San Diego, 1979.

Fredlund, J. Eric and Little, Roger D., Socioeconomic Characteristics of the All Volunteer Force: Evidence from the National Logitudinal Survey, 1979, U.S. Naval Academy, 1982.

Griffin, Patricia, A First Term Severity Index for U.S. Navy Ratings, M.S. Thesis, Naval Postgraduate School, 1981.

Koehler, Ernest A., Life Cycle Navy Enlisted Billet Costs - FY 79 (NPRDC TR 79-13), Navy Personnel Research and Development Center, San Diego, 1979.

Koehler, Ernest A., Manpower Availability Projections for Selected Constrained Ratings - FY 1981-1987 (NPRDC TR 82-39), Navy Personnel Research and Development Center, 1982.

Lockman, Robert G. and O'Neill, David M., Accession and Retention in the Navy, Summary Report 2, Center for Naval Analysis, Alexandria, 1973.

Lockman, Robert G., Success Chances of Recruits Entering the Navy (CNS-1086), Center for Naval Analysis, Arlington, 1977.

Marcus, Alan J., Personnel Characteristics and Navy Aviation Squadron Performance: A Production Function Approach, Center for Naval Analysis, 1982.

Military Manpower Task Force, A Report to the President on the Status and Prospects of the All Volunteer Force, U.S. Government Printing Office, 1982.

Naval Manpower Research in the 1980's Conference Proceedings (CNR 58), Center for Naval Analysis, 1983.

Navy Enlisted Initial Skill Rating Pipelines, CNET Notice 1514, Pensacola, 1981.

Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), Profile of American Youth: 1980 Nationwide Administration of the Armed Services Vocational Aptitude Battery, U.S. Government Printing Office, 1982.

Ruff, Richard R., Shylo, Bruce J., Orth, Mollie N., and Fraser, Jeannette L., Military Training: Potential Roles for Vocational Education, Ohio State University, 1981.

Rowe, Murry W., "Manpower Models as Tools of Military Planning", Defense Management Journal, Fourth Quarter 1982.

Thomas, George, The Feasibility of Modelling the Supply of Older Age Accessions, Naval Postgraduate School, 1982.

Vineberg, Robert and Joyner, John N., Performance of Men in Different Mental Categories, Human Resources Research Organization, 1978.

Warner, John T. and Goldberg, Matthew S., The Influence of Non-Pecuniary Factors on Labor Supply: the Case of Navy Enlisted Personnel, Center for Naval Analysis, 1982.

Warner, John T. and Thompson, Frederick, The Navy's Process for Planning Specialized Training (CNA 77-1230), Center for Naval Analysis, 1977.

# INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2. Library, Code 0142 Naval Postgraduate School Monterey, California 93943	2
3. Professor Thomas Swenson, Code 54Zw Naval Postgraduate School Monterey, California 93943	1
4. Professor Richard Elster, Code 54Ea Naval Postgraduate School Monterey, California 93943	2
5. Professor William McGarvey, Code 54 Naval Postgraduate School Monterey, California 93943	2
6. CDR Frank Keller, USN, Code 54 Naval Postgraduate School Monterey, California 93943	1
7. LCDR Clyde D. Sandel, USN Air Antisubmarine Squadron 32 FPO New York 09501	1
8. LT Mary F. Gleason, USN (Code 13) Commander Naval Telecommunications Command 4401 Massachusetts Avenue N.W. Washington, DC 20390	1

END

FILMED

3-84

DTIC